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# Prescriptions for Bedtime Sedatives After the Introduction of a General Admission Order Set at an Academic Health Center: The Potential and Pitfalls of Order Sets

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**Objective:** This study describes the impact of modifications to a general admission order set on physician prescribing of 2 as-needed or pro re nata (PRN) bedtime sedatives.

**Methods:** The hospitalists at our institution have used a general medical admission order set since 2005. Zolpidem was the only as-needed (PRN) bedtime sedative option on the order set until trazodone was added in December 2008. Trazodone is preferred over zolpidem in the geriatric population. We identified patients admitted by the hospitalists between January 2007 and August 2013 who were prescribed with either zolpidem or trazodone as a PRN sedative. Patient demographics, date and time of the order, and number of sedative doses administered during the hospitalization were recorded. Orders placed within 12 hours of admission were attributed to admission orders.

**Results:** Between 2007 and 2013, the number of patients admitted by the hospitalists with an order for PRN trazodone on admission increased by 18-fold. During the same period, the number of admissions by the hospitalists increased by 2.3 times. Zolpidem orders exceeded those for trazodone in all age groups until 2008. After the addition of trazodone, its use exceeded that of zolpidem. Almost half (48%) of all patients did not have a dose of the PRN trazodone administered.

**Conclusions:** Although order sets can be leveraged to align practitioners with established guidelines, the expediency of using medications on an order set may overcome physicians' clinical judgment. The content of an order set therefore deserves careful scrutiny before implementation.

**Key Words:** standardized order sets, unintended consequences, prescribing habits, patient safety

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In the decade following the Institute of Medicine's report highlighting the morbidity and mortality attributable to medical errors, there has been an increased focus on improving patient safety.<sup>1,2</sup> Medication errors in the hospital are common, with one study estimating an error in 1 of every 5 doses administered.<sup>3</sup> Assessments of the effect of computerized physician order entry with decision support in the form of alerts, reminders, order sets, and guidelines have been overwhelmingly

positive.<sup>4</sup> Similarly, order sets have been shown to both enhance adherence to consensus practice guidelines and improve outcomes and documentation in specific medical conditions and settings.<sup>5–8</sup> However, fewer studies address the impact of a general medical admission standardized order set alone on physician prescribing habits, with our search yielding only 3 publications that address the issue.<sup>9–11</sup> Insomnia is a common complaint in the hospital, with prevalence rates reported between 36.7% and 56.5%.<sup>12</sup> Although insomnia in older adults can cause cognitive deficits, its treatment with pharmacologic agents can also be problematic.<sup>13,14</sup> In this work, we report the trends in the ordering of 2 bedtime pro re nata (PRN) or as-needed sedatives at our institution and explore their relationship to order set content.

## METHODS

This study was reviewed and approved by the Indiana University Institutional Review Board. The study site was Indiana University Health Methodist Hospital, which is an academic health center with more than 800 beds located in Indianapolis, Indiana.<sup>15</sup> Hospitalists have been employed at Methodist Hospital since 1998 and implemented the first standardized general hospital admission order set in January 2005. The first version was a paper-based template that has undergone multiple revisions. The current version is an electronic computerized physician order entry template, which is universally used by the hospitalists when admitting a patient. Each iteration of the order set reflects changes in national consensus practice guidelines in addition to local clinical practice. A multidisciplinary committee of clinical practitioners, pharmacists, and information technology representatives reviews the order set modifications. In addition to the general medical admission order set, diagnosis-specific order sets are also available at our institution including order sets for pneumonia, management of hyperglycemia, anticoagulation, and acute coronary syndromes. The general medical admission order set content addresses diet, activity, allergies, frequency of vital sign monitoring, call orders, admitting team information, laboratory and diagnostic testing, and medications. As-needed medication options that are presented in the order set address commonly encountered complaints in the hospital and include antiemetics, antihypertensives, bowel regimens, and sedatives. The use of the order set is voluntary, all orders can be modified, and no orders are mandatory. Additional orders can be added as necessary. The order sets are available as supplementary material (Supplemental Digital Content, <http://links.lww.com/JPS/A13>) for review.

Between January 2005 and November 2008, zolpidem was the only PRN bedtime sedative option available on the order set. Trazodone was added in December 2008. There was no wording encouraging its use in the elderly population or alerts when zolpidem was used in geriatric patients. This study focused on the ordering patterns and administration for each sedative during a retrospective 6-year period that spanned the addition of trazodone to the admission order set.

A data inquiry was performed on the institution's electronic medical record encompassing inpatient hospitalist admissions between January 2007 and August 2013. The query identified

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**TABLE 1.** Demographics of Patients Ordered As-Needed Zolpidem and Trazodone From January 2007 to August 2013

Characteristics		Zolpidem	Trazodone
Total		3812	5009
Order placed within 12 h of admission		2055	2667
Sex	Female	2064 (54%)	2882 (57.5%)
	Male	1748 (46%)	2127 (42.4%)
Age range, y		18–98	18–109
Mean age, y		56.7	67.4

records of patients only if they were admitted by a hospitalist and had an order for PRN zolpidem or trazodone at any point during the entire hospitalization. Search criteria in the data inquiry included “zolpidem” or “trazodone” with a frequency of “QHS PRN” or “at bedtime PRN.” All dosage strengths for each sedative were included. Data extracted from the generated report included patient sex, age, date and time of admission, timing of the order for the sedative, and the number of doses administered. Orders for PRN zolpidem and trazodone placed within 12 hours of admission were attributed to admission orders.

The number of admissions to the hospitalist service between January 2007 and August 2013 was also obtained through querying the electronic medical record. Yearly rates of ordering PRN zolpidem and trazodone on admission were obtained by dividing the number of orders for the relevant medication placed by the number of admissions to the hospitalist service for that year.

## RESULTS

Between January 2007 and August 2013, there were a total of 3812 medication orders for zolpidem and 5009 for trazodone. Of these, 2055 zolpidem orders (54%) and 2677 trazodone orders (53%) were placed within 12 hours of admission and therefore attributed to orders placed on admission. There was a similar distribution of male and female patients. The mean age of those prescribed with trazodone was a decade more than those prescribed zolpidem (Table 1).

Before the addition of zolpidem to the order set, the number of zolpidem orders placed on admission exceeded those for trazodone, even in patients older than 65 years. Only after the order set modification in December 2008, which added the option of bedtime PRN trazodone, did the number of trazodone orders on admission exceed those for zolpidem. This difference was specially marked in older adults. This trend remained stable during

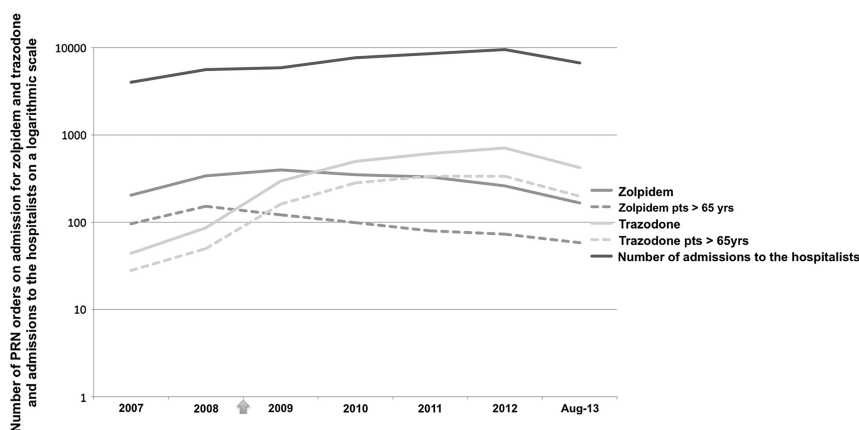
the rest of the study period, with more trazodone being ordered than zolpidem. Although the orders for trazodone on admission increased by 18-fold between 2007 and 2012, admissions to the hospitalist service during the same period only increased by approximately 2.5 times (Fig 1).

Before the introduction of PRN trazodone as an option in December 2008, the percentage of patients admitted to the hospitalist service with admit orders for PRN trazodone was less than 1.5% compared with 6% for zolpidem. The following year (2009), 5% of the patients admitted by the hospitalists had orders for PRN trazodone on admission. The percentage of patients with orders for PRN zolpidem showed a decline for the rest of the study period (Fig 2).

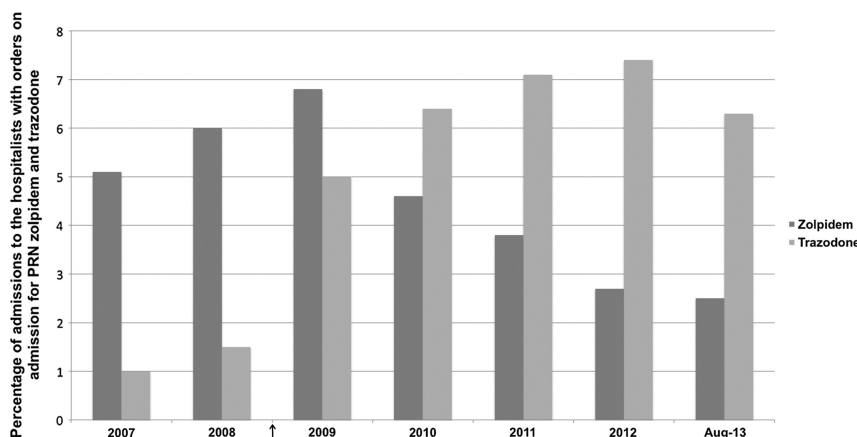
Overall, 39% (n = 1487) of all orders for zolpidem did not result in an administration of a dose to the patient during the course of the hospitalization. Similarly, nearly half (n = 2430, 48.5%) of all orders for PRN trazodone remained unused. These rates of nonuse were higher for orders placed on admission. For zolpidem, 48% of the orders placed on admission were never used, whereas 28% of the orders placed later in the hospital stay were never administered to the patient. For trazodone, 69% of the orders placed on admission were never used, whereas 24% of those ordered later in the hospital stay remained unused (Fig 3).

## DISCUSSION

Harm during routine medical care remains common and is often avoidable.<sup>16</sup> Standardization of practice for specific conditions and specific medications through the use of evidence-based order sets has been widely demonstrated to increase adherence to established guidelines while improving patient outcomes including decreased mortality and length of stay.<sup>17</sup> General inpatient admission order sets are frequently used with the expectation that they will increase the efficiency of order entry while being more comprehensive. The broad



**FIGURE 1.** Number of PRN orders for zolpidem and trazodone placed on admission and number of admissions to the hospitalists between January 2007 and August 2013 on a logarithmic scale. Orders placed within 12 hours of admission were attributed to admit orders. The arrow depicts December 2008 when trazodone was added to the order set.



**FIGURE 2.** Percentage of patients admitted to the hospitalist service with orders for PRN zolpidem and trazodone placed on admission between January 2007 and August 2013. Orders placed within 12 hours of admission were attributed to admit orders. The arrow depicts December 2008 when trazodone was added to the order set.

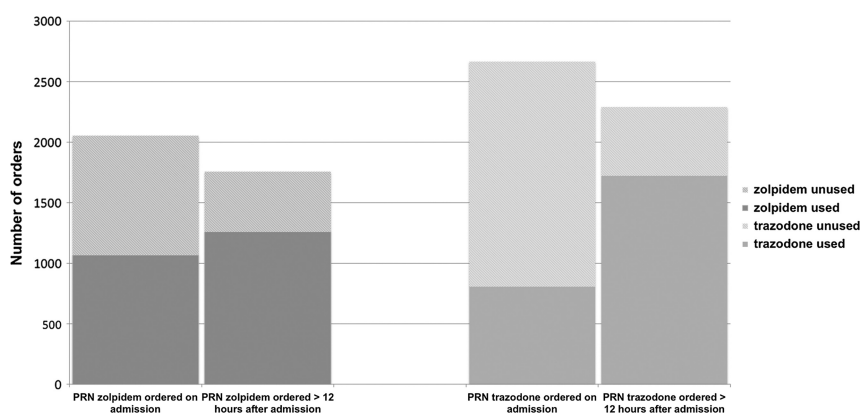
scope and generality of admission order sets make their impact on outcomes harder to measure, and fewer studies report the outcomes attributable to them. However, evaluating the outcomes tied to general medical admission order sets is critical as the presence of an order set alone does not predict the caliber of care delivered and high-performing hospitals tend to parallel their organizational culture of excellence and leadership involvement.<sup>18</sup> Carefully constructed order sets may result in better outcomes. One investigation reported that higher-quality sedation and analgesia order sets were associated with a decreased duration of mechanical ventilation in the intensive care unit.<sup>19</sup> Unlike disease-specific order sets, which follow established practice guidelines, there is less guidance available for general medical admission order sets. Therefore, they are likely to reflect the local consensus and identified needs of the institution. As after-hour calls frequently necessitate the prescribing of medications, PRN medication orders on order sets are often directed at common complaints in the hospital including insomnia, nausea, and pain.<sup>20,21</sup> Although guidelines such as those by the Institution of Safe Medication Practices can assist in the development of order sets, best practices for general medical admission order sets have not been established.<sup>22</sup> To address this gap, metrics to measure and report the quality of general admission order sets may need to be developed, and collaboration between institutions may be beneficial. Such collaborative efforts have previously been suggested by Dale et al in the context of intensive care and have existing precedents in hospital medicine such as the

Society of Hospital Medicine's Quality Improvement Network (SQUINT).<sup>23</sup>

Zolpidem use in the hospital may be associated with delirium and falls, which may favor the use of trazodone as a sleep aid during hospitalization, particularly in older adults.<sup>24</sup> However, our study demonstrates that while zolpidem was the only choice on the order set, its use exceeded that of trazodone in all age groups. After the order set modification in 2008 introducing trazodone as a PRN option, we found an increase in trazodone orders, surpassing those for zolpidem. The largest differences were seen in patients older than 65 years, indicating that practitioners were appropriately selecting trazodone in the geriatric population, despite the lack of prompts to guide them. This shift from zolpidem to trazodone in older adults brought our institution in closer alignment to national guidelines.<sup>25</sup>

This trend illustrates that modifications in the content of the order set alone, without accompanying alerts or decision support guidance, can be leveraged to alter medication ordering habits. However, our findings also raise the concern that the expediency of ordering a medication that is presented as a choice in the order set can outweigh appropriate clinical decision making and drive ordering practices. This underscores the critical need of vetting the content of an order set before implementation.

Although the addition of trazodone to the order set increased its use in the elderly, we found that this increase vastly exceeded the



**FIGURE 3.** Orders for PRN zolpidem and trazodone that were unused and used. Unused orders were those that did not result in an administration of a dose to the patient throughout hospitalization. Orders placed within 12 hours of admission were attributed to admit orders.

increase in the admissions to the hospitalists. Interventions to improve quality carry the potential for unintended consequences, necessitating thoughtful and deliberate adoption.<sup>26</sup> For example, Khanna et al<sup>11</sup> found that an order set for venous thromboembolism prophylaxis resulted in a transient increase in prophylaxis ordering in patients who were at risk for harm from it. Similarly, another investigation found an unintended increase in nighttime sedation use with the implementation of a general admission order set.<sup>9</sup> It appears that simply making a medication easier to order prompts the practitioner to utilize it. A previous investigation has reported that up to 84% of sedatives prescribed to elderly patients admitted to a psychiatry unit were done so without a clearly documented indication and were therefore potentially inappropriate.<sup>27</sup> The American Academy of Sleep Medicine recommends an initial nonpharmacologic approach for insomnia because older adults have a higher risk of developing psychomotor adverse effects from sedative drugs.<sup>28</sup> The process of weighing such risks and benefits, along with considering evolving recommendations, needs to be emphasized as order sets are developed and maintained. It is likely that presenting them as options in the order set can encourage the use of nonpharmacologic interventions.

The impact of a medical error can be debilitating not only for the patient but also for the care provider.<sup>29</sup> Medication administration errors remain frequent during hospitalization. One situation with a high potential for error occurs during prescriber cross coverage. After-hour calls by nursing often result in a medication order by a covering practitioner who may not be as familiar with the patient's medical history. This discontinuity between providers may potentiate errors and has prompted the recommendation to include appropriate PRN medications in order sets. Sedatives have been included in our institution's order sets since inception, with a consistent increase in medication orders over time. Although the ordering of sedatives increased, almost half of the prescribed as-needed sedatives were never administered during the hospitalization. Nurses cite workload, patient severity of illness, and polypharmacy as contributors culminating in an increased risk for medication administration errors.<sup>30</sup> The redundancy created by an unused order on a patient's medication profile must be balanced against the possible advantage of limiting after-hour calls.

Our work has certain limitations. It is a single-center observational study, and the trends may not be generalizable. The associations found with order set prescribing are based on analyses trended over time, and the authors cannot comment on concomitant factors that may have affected the prescribing habits of the hospitalists. As this is an observational study, these associations do not imply causation. Although this study reports the prescribing habits of the hospitalists at one institution, prescribing habits of individual practitioners were not investigated. Therefore, it is possible that a smaller set of practitioners within the hospitalists were driving the trends. We did not extract the appropriateness of each order or measure the outcomes that may have been affected by the changes in ordering habits such as falls or delirium. There was also a lack of a comparison group to other inpatient services that did not use the order set. Finally, the data were extracted retrospectively from the institution's electronic medical record system with its attendant inherent limitations.<sup>31</sup>

## CONCLUSIONS

Order sets are a valuable and powerful tool that can be used to standardize practice and alter prescribing patterns in the inpatient setting. The consistent success of order sets in modifying ordering habits in diverse settings amplifies the importance that should be placed on the scrutiny of their development, content, and ongoing maintenance. The quality of order sets varies between hospitals,

and initiatives to measure and report on their quality may benefit from collaboration between institutions. Based on our review of PRN prescribing patterns of 2 PRN sedatives, order sets may increase the ordering of medications that remain unused. Further studies at assessing the risks and benefits of PRN medications during hospitalization may be warranted.

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